

Claims:

1 1. A storage subsystem (hereinafter, referred to as the
2 storage subsystem in question) in a computer system in which a
3 plurality of storage subsystems are sequentially concatenated to a
4 host computer and remote copy is performed between said
5 plurality of storage subsystems, wherein:
6 said storage subsystem in question comprises:
7 an interface which receives status information acquisition
8 command and which sends status information from and to a
9 storage subsystem (hereinafter, referred to as an upstream
10 storage subsystem) that is located on a nearer side of the storage
11 subsystem in question seen from the host computer and connected
12 to the storage subsystem in question;
13 an outgoing status information storage unit which stores
14 said status information (hereinafter, referred to outgoing status
15 information) to be sent to said upstream storage subsystem;
16 a target storage subsystem judgment unit which judges
17 whether a target storage subsystem (meaning a storage subsystem
18 from which said status information is to be acquired) stored in the
19 status information acquisition command received through said
20 interface is the storage subsystem in question;
21 a command downstream sending unit which sends said
22 status information acquisition command to a storage subsystem
23 (hereinafter, referred to as a downstream storage subsystem) that
24 is located on a farther side of the storage subsystem in question
25 seen from the host computer and connected to the storage

26 subsystem in question, when said target storage subsystem
27 judgment unit judges that the storage subsystem in question is
28 not said target storage subsystem from which said status
29 information is to be acquired;

30 a self status information acquisition unit which acquires
31 the status information of the storage subsystem in question and
32 which stores the acquired status information as said outgoing
33 status information into said outgoing status information storage
34 unit, when said target storage subsystem judgment unit judges
35 that the storage subsystem in question is said target storage
36 subsystem from which said status information is to be acquired;
37 and

38 a downstream status information acquisition unit which
39 receives the status information from said downstream storage
40 subsystem and which stores the received status information as
41 said outgoing status information into said outgoing status
42 information storage unit;

43 and

44 after said self status information acquisition unit or said
45 downstream status information acquisition unit stores said
46 outgoing status information into said outgoing status information
47 storage unit, said interface sends said status information stored.

1 2. A storage subsystem according to Claim 1, further
2 comprising:

3 a concatenation position judgment unit which judges a
4 concatenation position of the storage subsystem in question based
5 on information stored in said status information acquisition

6 command received from said upstream storage subsystem;
7 wherein:

8 when said concatenation position judgment unit judges
9 that the storage subsystem in question is a storage subsystem
10 (hereinafter, referred to as a direct-coupled storage subsystem)
11 connected to said host computer, then, said interface sends the
12 outgoing status information stored in said outgoing status
13 information storage unit to said host computer.

1 3. A storage subsystem according to Claim 2, wherein:

2 when said target storage subsystem judgment unit judges
3 that said target storage subsystem is all of said plurality of
4 storage subsystems (including the storage subsystem in question)
5 sequentially concatenated from said host computer, and said
6 concatenation position judgment unit judges that the storage
7 subsystem in question is not a storage subsystem (hereinafter,
8 referred to as an end storage subsystem) concatenated at a
9 farthest position seen from said host computer among said
10 plurality of storage subsystems sequentially concatenated, then,
11 said command downstream sending unit sends said status
12 information acquisition command to the downstream storage
13 subsystem connected to the storage subsystem in question;

14 said self status information acquisition unit adds the
15 acquired status information of the storage subsystem in question
16 to the status information that is received by said downstream
17 status information acquisition unit from said downstream storage
18 subsystem and stored in said outgoing status information storage
19 unit, and then, said self status information acquisition unit stores

20 resultant status information as the outgoing status information
21 into said outgoing status information storage unit; and
22 after said self status information acquisition unit stores
23 said outgoing status information into said outgoing status
24 information storage unit, said interface sends said status
25 information.

1 4. A storage subsystem according to Claim 3, wherein:
2 when said target storage subsystem judgment unit judges
3 that said target storage subsystem is all of said plurality of
4 storage subsystems (including the storage subsystem in question)
5 sequentially concatenated from said host computer, and said
6 concatenation position judgment unit judges that the storage
7 subsystem in question is not the end storage subsystem, then,
8 said command downstream sending unit instructs said self status
9 information acquisition unit to acquire the status information of
10 the storage subsystem in question and to store the acquired status
11 information as the outgoing status information into said outgoing
12 status information storage unit.

1 5. A storage subsystem according to Claim 4, further
2 comprising an acquired information judgment unit which judges
3 whether status information whose acquisition is requested by the
4 status information acquisition command received is newest status
5 information; wherein:
6 when said acquired information judgment unit judges that
7 the newest status information is not requested, said concatenation
8 position judgment unit judges that the storage subsystem in

9 question is a direct-coupled storage subsystem, and said outgoing
10 status information storage unit holds the outgoing status
11 information, then, said interface sends the held status
12 information to the host computer without awaiting that said self
13 status information acquisition unit or said downstream status
14 information acquisition unit stores outgoing status information
15 into said outgoing status information storage unit.

1 6. A storage subsystem (hereinafter, referred to as the
2 storage subsystem in question) in a computer system in which a
3 plurality of storage subsystems are sequentially concatenated to a
4 host computer and remote copy is performed between said
5 plurality of storage subsystems, wherein:

6 said storage subsystem in question comprises:

7 an interface which receives status information acquisition
8 command and which sends status information from and to a
9 storage subsystem (hereinafter, referred to as an upstream
10 storage subsystem) that is located on a nearer side of the storage
11 subsystem in question seen from the host computer and connected
12 to the storage subsystem in question;

13 an outgoing status information storage unit which stores
14 said status information (hereinafter, referred to outgoing status
15 information) to be sent to said upstream storage subsystem;

16 a concatenation position judgment unit which judges a
17 concatenation position of the storage subsystem in question based
18 on information stored in said status information acquisition
19 command received from said upstream storage subsystem; and

20 a status information acquisition unit:

21 that acquires the status information of the storage
22 subsystem in question at status information acquisition time
23 intervals stored in the status information acquisition command, to
24 store the acquired status information into the outgoing status
25 information storage unit, when said concatenation position
26 judgment unit judges that the storage subsystem in question is a
27 storage subsystem (hereinafter, referred to as an end storage
28 subsystem) located at a farthest position in concatenation order
29 seen from the host computer; and

30 that acquires the status information of the storage
31 subsystem in question at time of receiving status information
32 from a storage subsystem (hereinafter, referred to as a
33 downstream storage subsystem) connected to and located on a
34 farther side of the storage subsystem in question seen from the
35 host computer, and adds the status information of the storage
36 subsystem in question to the received status information of said
37 downstream storage subsystem, to store resultant status
38 information to the status information storage unit; and

39 when the concatenation position judgment unit judges that
40 the storage subsystem in question is not a storage subsystem
41 (hereinafter, referred to as a direct-coupled storage subsystem)
42 connected directly to the host computer, then, said interface sends
43 all of said status information stored in the status information
44 storage unit to said upstream storage subsystem.

1 7. A computer system in which a plurality of storage
2 subsystems according to Claim 1 are sequentially concatenated to
3 a host computer and remote copy is performed between said

4 plurality of storage subsystem, wherein:
5 said host computer comprises:
6 a status information acquisition command generation unit
7 which generates said status information acquisition command;
8 a status information acquisition unit which receives status
9 information from said plurality of storage subsystems;
10 a status information holding unit which holds the status
11 information acquired by said status information acquisition unit;
12 and
13 a remote copy adjustment unit which generates
14 information for adjusting remote copy according to said status
15 information held in said status information holding unit.

1 8. A status information acquisition method for acquiring
2 status information of a plurality of storage subsystems
3 (hereinafter, referred to remote storage subsystems) in a
4 computer system in which said remote storage subsystems are
5 concatenated sequentially to a storage subsystem directly coupled
6 to a host computer, said status information acquisition method
7 comprising:
8 receiving a status information acquisition command from a
9 storage subsystem (hereinafter, referred to as an upstream
10 storage subsystem) that is connected to a storage subsystem
11 (hereinafter, referred to a storage subsystem in question), and is
12 located on a nearer side of the storage subsystem in question seen
13 from the host computer;
14 judging whether the storage subsystem in question stored
15 in said status information acquisition command is a target storage

16 subsystem (meaning a storage subsystem from which status
17 information is to be acquired) by analyzing the received status
18 information acquisition command; and

19 when it is judged that the storage subsystem in question is
20 the target storage subsystem, then, the storage subsystem in
21 question acquires the status information of the storage subsystem
22 in question itself and sends the acquired status information to
23 said upstream storage subsystem; and

24 when it is judged that the storage subsystem in question is
25 not the target storage subsystem, then, the storage subsystem in
26 question sends the received status information acquisition
27 command to a storage subsystem (hereinafter, referred to as a
28 downstream storage subsystem) connected to and located on a
29 farther side of the storage subsystem in question seen from the
30 host computer, and thereafter, when status information of said
31 downstream storage subsystem is received from the downstream
32 storage subsystem, the storage subsystem in question sends the
33 received status information to the upstream storage subsystem.

1 9. A status information acquisition method for acquiring
2 status information of a plurality of storage subsystems
3 (hereinafter, referred to remote storage subsystems) in a
4 computer system in which said remote storage subsystems are
5 sequentially concatenated in a sequence, said status information
6 acquisition method comprising:

7 receiving a status information acquisition command from a
8 storage subsystem (hereinafter, referred to as an upstream
9 storage subsystem) that is connected to a storage subsystem

10 (hereinafter, referred to as a storage subsystem in question) and
11 is located on a nearer side of the storage subsystem in question
12 seen from the host computer;

13 judging whether the storage subsystem in question is a
14 storage subsystem (hereinafter, referred to as an end storage
15 subsystem) concatenated at a farthest position in said sequence
16 seen from the host computer by analyzing the received status
17 information acquisition command;

18 when it is judged that the storage subsystem in question is
19 the end storage subsystem, then, the storage subsystem in
20 question acquires the status information of the storage subsystem
21 in question itself and sends the acquired status information to
22 said upstream storage subsystem connected to the storage
23 subsystem in question; and

24 when it is judged that the storage subsystem in question is
25 not the end storage subsystem, then, the storage subsystem in
26 question sends the received status information acquisition
27 command to a storage subsystem (hereinafter, referred to as a
28 downstream storage subsystem) connected to and located on a
29 farther side of the storage subsystem in question seen from the
30 host computer, and thereafter, when status information is
31 received from said downstream storage subsystem, the storage
32 subsystem in question adds the status information of the storage
33 subsystem in question to the status information received from the
34 downstream storage subsystem to obtain new status information,
35 and sends the new status information to the upstream storage
36 subsystem.

1 10. A status information monitoring method for monitoring
2 remote copy status of a plurality of storage subsystem
3 (hereinafter, referred to remote storage subsystems) in a
4 computer system in which said remote storage subsystems are
5 sequentially concatenated in sequences to storage subsystems
6 (hereinafter, referred to as direct-coupled storage subsystems)
7 directly coupled to a host computer, said status information
8 monitoring method comprising:
9 generating a status acquisition command for acquiring, at
10 regular time intervals, remote copy status information of all the
11 storage subsystems constituting a specific sequence connected to
12 the host computer, in said host computer;
13 sending the generated status acquisition command to a
14 direct-coupled storage subsystem;
15 receiving the sent status acquisition command in said
16 direct-coupled storage subsystem;
17 when the received status acquisition command is a
18 command for acquiring the status information of the sequence to
19 which the direct-coupled storage subsystem in question belongs,
20 the status acquisition command is sent to a downstream remote
21 storage subsystem connected to the direct-coupled storage
22 subsystem in question;
23 sending the received command at said remote storage
24 subsystem, up to a remote storage subsystem connected at an end
25 farthest from the host computer in the sequence,;
26 acquiring said status information to be sent to an
27 upstream storage subsystem connected to the remote storage
28 subsystem in question itself, at said remote storage subsystem

29 connected at the end according to the received status acquisition
30 command;

31 judging whether the storage subsystem in question
32 is a remote storage subsystem or a direct-coupled storage
33 subsystem at said storage subsystem which acquires said status
34 information; and

35 at said storage subsystem received said status information,
36 when it is judged that the storage subsystem in question is
37 a remote storage subsystem, then, repeating,

38 adding the status information of the storage subsystem in
39 question to the status information received from a downstream
40 remote storage subsystem connected to the storage subsystem in
41 question, and sending resultant status information to an
42 upstream storage subsystem connected to the storage subsystem
43 in question,

44 until said upstream storage subsystem becomes a
45 direct-coupled storage subsystem and the direct-coupled storage
46 subsystem holds the status information, and

47 when it is judged that the storage subsystem in question is
48 a direct-coupled storage subsystem, then, holding the acquired
49 status information;

50 generating a status information acquisition command for
51 acquiring remote copy status information (held by a direct-coupled
52 storage subsystem) of all the storage subsystems constituting a
53 specific sequence connected to the host computer at the host
54 computer;

55 sending the generated status information acquisition
56 command to said direct-coupled storage subsystem;

57 receiving the sent status information acquisition command;
58 and sending the status information acquired and held by the
59 direct-coupled storage subsystem in question to the host computer
60 when a sequence designated by said command as a sequence from
61 which status information is to be acquired is a sequence to which
62 the direct-coupled storage subsystem in question belongs); and
63 receiving to be held the sent status information in the host
64 computer.

1 11. A storage subsystem (hereinafter, referred to as the
2 storage subsystem in question) in a computer system in which a
3 plurality of storage subsystems are sequentially concatenated to a
4 host computer and remote copy is performed between said
5 plurality of storage subsystems, wherein:
6 said storage subsystem in question comprises an
7 arithmetic unit and a memory; and
8 said arithmetic unit performs:
9 processing of receiving a status information acquisition
10 command from a storage subsystem (hereinafter, referred to as an
11 upstream storage subsystem) that is located on a nearer side of
12 the storage subsystem in question seen from the host computer
13 and connected to the storage subsystem in question;
14 processing of judging whether a target storage subsystem
15 (meaning a storage subsystem from which said status information
16 is to be acquired) specified in said status information acquisition
17 command is the storage subsystem in question;
18 processing of sending said status information acquisition
19 command to a storage subsystem (hereinafter, referred to as a

20 downstream storage subsystem) that is located on a farther side of
21 the storage subsystem in question seen from the host computer
22 and connected to the storage subsystem in question, when it is
23 judged that the storage subsystem in question is not said target
24 storage subsystem from which said status information is to be
25 acquired; and processing of acquiring status information of the
26 storage subsystem in question itself and storing the acquired
27 status information as status information (hereinafter, referred to
28 as outgoing status information) to be sent into said memory, when
29 it is judged that the storage subsystem in question is the target
30 storage subsystem from which said status information is to be
31 acquired;

32 processing of receiving the status information from the
33 downstream storage subsystem and storing the received status
34 information as the outgoing status information into said memory;
35 and

36 processing of sending the status information stored in said
37 memory to said upstream storage subsystem.

1 12. A computer system in which a plurality of storage
2 subsystem according to Claim 6 are sequentially concatenated to a
3 host computer and remote copy is performed between said
4 plurality of storage subsystems, wherein:

5 said host computer comprises:

6 a status information acquisition command generation unit
7 which generates said status information acquisition command;

8 a status information acquisition unit which receives status
9 information from said plurality of storage subsystems;

10 a status information holding unit which holds the status
11 information acquired by said status information acquisition unit;
12 and
13 a remote copy adjustment unit which generates
14 information for adjusting remote copy according to said status
15 information held in said status information holding unit.